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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/776,475	02/10/2004	Lawrence C. Gunn III	LUXTRA.031A	4060

20995 7590 08/09/2006

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EXAMINER

PETKOVSEK, DANIEL J

ART UNIT	PAPER NUMBER
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2874

DATE MAILED: 08/09/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

**Office Action Summary**

Application No.

10/776,475

Applicant(s)

GUNN ET AL.

Examiner

Daniel J. Petkovsek

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on amendment filed May 22, 2006.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 1-52 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-49, 51 and 52 is/are rejected.
- 7) ☒ Claim(s) 50 is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on May 22, 2006 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

- |   |   |
|---|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)             | 4) <input type="checkbox"/> Interview Summary (PTO-413)                     |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)    | Paper No(s)/Mail Date. _____  |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| Paper No(s)/Mail Date _____   | 6) <input type="checkbox"/> Other: _____                                    |

### DETAILED ACTION

This office action is in response to the amendment filed May 22, 2006. In accordance with the amendment, claims 1, 15-19, and 28-31 have been amended. Claims 1-52 are pending.

#### *Drawings*

1. The new corrected drawings were filed on May 22, 2006 along with the amendment. These drawings are acknowledged.

#### *Claim Rejections - 35 USC § 102*

2. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

3. Claims 19, 21, 23, 27, 28, 32, 36-47, 51, and 52 are rejected under 35 U.S.C. 102(b) as being anticipated by Welch et al. U.S.P. No. 5,864,574.

Welch et al. U.S.P. No. 5,864,574 teaches (Fig. 9, column 9, line 65 through column 10, line 16) an integrated optical apparatus comprising: a planar waveguide having an elongate guiding portion 112 and a grating coupler 119, said coupler having at least a flared waveguide portion 114 comprising both a “relatively” narrow end and “relatively” wide end, the flared portion 114 having a grating positioned to couple light between said coupling waveguide and a further optical element; wherein the grating comprises curved elongate scattering elements which are substantially elliptical so as to couple waves between the grating and the optical elements, which clearly, fully meets Applicant’s *claimed* limitations. In a least one frame of reference, the optical element is

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located *above* the grating (if Welch was turned to a certain direction of placed below an optical element within a larger device).

Regarding claim 21, the numerical aperture of the flared portion (with a grating) is inherently smaller than the numerical aperture of the waveguide portion.

Regarding claim 23, a fiber can be coupled to the optical system (Figs. 19-20).

Regarding claim 27, the length of the sidewall substantially matches the width of the “relatively” wide end portion (see figures).

Regarding claim 28, the waveguide is at least a channel (see figures).

Regarding claim 32, the optical apparatus is disposed over a substrate.

Regarding claim 36, the structural limitations of the device of Welch et al. ‘574 make inherent the properties, since the same structural limitations are presented, with the coupling to an external fiber.

Regarding claims 37-40, the planar waveguiding region has sidewalls, and is a channel, while a flared portion exists, one end being narrow, the opposite being wide (see Fig. 9).

Regarding claim 41, the concave side faces the narrow portion of the waveguide.

Regarding claim 42, the curves are substantially elliptically shaped.

Regarding claims 43 and 44, a single mode fiber can be employed in the optical system (Figs. 19 and 20), which supports a single optical mode.

Regarding claim 45, the waveguide inherently *can* support a single polarization by its geometry.

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Regarding claim 46, the cross section of the fiber can be substantially larger (see Fig. 19).

Regarding claim 47, for proper propagation, the numerical aperture of the waveguide can be substantially larger than the fiber.

Regarding claim 51, the system inherently acts in this manner since all of the structural limitations are met by the device of Welch et al. '574.

Regarding claim 52, the curvature is substantially circular path-like.

4. Claims 1-4, 6-9, 13, 15, 19-21, 23, 27, 28, 32, 36-45, 47, 51, and 52 are rejected under 35 U.S.C. 102(b) as being anticipated by O'Brien et al. U.S.P. No. 5,793,521.

O'Brien et al. U.S.P. No. 5,793,521 teaches (Figs. 5, 7, 12a, 30, 31; column 9, lines 19-36; column 11, lines 41-53; column 13, lines 16-36) an integrated optical apparatus comprising: a planar waveguide having an elongate guiding portion 160 and a grating coupler 161, the coupler having at least a flared waveguide portion comprising a narrow end and a wide end, the grating positioned to couple an optical signal between the coupler and an optical element, wherein the grating 161 comprises curved elongate scattering elements having curvatures defined by substantially elliptical paths in order to couple waves between the grating coupler and an optical element, which clearly, fully meets Applicant's *claimed* limitations (claim 19). In a least one frame of reference, the optical element is located *above* the grating (if O'Brien was turned to a certain direction of placed below an optical element within a larger device).

Regarding claim 1 (and dependent claim 20), in another embodiment (see Fig. 5), the flared portion is disclosed having curved sidewalls in a substantially hyperbolic path.

Regarding claims 2-4, the grating comprises curved elongate scattering elements that are both *substantially* elliptical and circular.

Regarding claims 6 and 23, an optical single mode fiber can be coupled thereto.

Regarding claim 7, the two curved sidewalls *can* support this particular propagation.

Regarding claims 8 and 21, the numerical aperture of the flared portion (with a grating) is inherently smaller than the numerical aperture of the waveguide portion.

Regarding claim 9, the spacing is inherently selected to attain the desired result.

Regarding claims 13 and 27, the length *substantially* matches the width in certain embodiments.

Regarding claims 15 and 28, the waveguide at least is formed in a channel.

Regarding claim 32, the optical apparatus is disposed over a substrate.

Regarding claim 36, the structural limitations of the device of O'Brien et al. '521 make inherent the properties, since the same structural limitations are presented, while a fiber can be coupled to the end of the grating coupler (column 10, lines 53-67).

Regarding claims 37-40, the planar waveguiding region has sidewalls, and is a channel, while a flared portion exists, one end being narrow, the opposite being wide (see Figs. 12a, 30, 31).

Regarding claim 41, the concave side faces the narrow portion of the waveguide (Fig. 31).

Regarding claim 42, the curves are substantially elliptically shaped.

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Regarding claims 43 and 44, a single mode fiber can be employed in the optical system, which supports a single optical mode.

Regarding claim 45, the waveguide inherently *can* support a single polarization by its geometry.

Regarding claim 47, for proper propagation, the numerical aperture of the waveguide *can* be substantially larger than the fiber.

Regarding claim 51, the system inherently acts in this manner since all of the structural limitations are met by the device of O'Brien et al. '521.

Regarding claim 52, the curvature is substantially circular path-like.

### ***Claim Rejections - 35 USC § 103***

5. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

6. Claims 1-18, 20, 22, 24-26, 29-31, 33-35, 48 and 49 are rejected under 35 U.S.C. 103(a) as being unpatentable over Welch et al. U.S.P. No. 5,864,574, and further in view of O'Brien et al. U.S.P. No. 5,793,521.

Welch et al. U.S.P. No. 5,864,574 teaches (Fig. 9, column 9, line 65 through column 10, line 16) an integrated optical apparatus comprising: a planar waveguide having an elongate guiding portion 112 and a grating coupler 119, said coupler having at least a flared waveguide portion 114 comprising both a "relatively" narrow end and "relatively" wide end, the flared portion 114 having a grating positioned to couple light

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between said coupling waveguide and a further optical element; wherein the grating comprises curved elongate scattering elements which are substantially elliptical so as to couple waves between the grating and the optical elements.

Welch et al. '574 does not explicitly teach that the flare portion has curved sidewalls having a hyperbolic path (and further dependent claim limitations)

O'Brien et al. U.S.P. No. 5,793,521 teaches (Figs. 7, 12a, 30, 31; column 9, lines 19-36; column 11, lines 41-53; column 13, lines 16-36) an integrated optical apparatus comprising: a planar waveguide having an elongate guiding portion 160 and a grating coupler 161, the coupler having at least a flared waveguide portion comprising a narrow end and a wide end, the grating positioned to couple an optical signal between the coupler and an optical element, wherein the grating 161 comprises curved elongate scattering elements having curvatures defined by substantially elliptical paths in order to couple waves between the grating coupler and an optical element. O'Brien also teaches (Fig. 5) that the flared portion can have curved sidewalls to define a substantially hyperbolic path.

Since Welch et al. '574 and O'Brien et al. '521 are both from the same field of endeavor, the purpose disclosed by O'Brien et al. '521 would have been recognized in the pertinent art of Welch et al. '574.

It would have been obvious at the time the invention was made to a person having ordinary skill in the art to modify the flared portion of the tapering waveguide structure of O'Brien et al. '521 into the straight lined flared portion of Welch et al. '574 for the purpose of improving the optical coupling capabilities of the waveguide device, by allowing for certain optical wavefronts to be passed through the structure. A person having ordinary skill in the art at the time the invention was made would have recognized



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using curved sidewalls for this purpose, in order to improve coupling and decrease error for certain types of wavefronts, when coupled through an optical system such as the one of Welch et al. '574.

Regarding claims 2-4, the grating comprises curved elongate scattering elements that are both *substantially* elliptical and circular.

Regarding claims 5, 22, and 49, although not explicitly disclosed as being at least 50% efficient, a person having ordinary skill in the art at the time the invention was made would have recognized that optical efficiency was desired and necessary for the systems (of at least 50%). Official notice has been taken of the efficiency limitation.

Regarding claims 6, an optical single mode fiber can be coupled thereto.

Regarding claim 7, the two curved sidewalls *can* support this particular propagation.

Regarding claims 8, the numerical aperture of the flared portion (with a grating) is inherently smaller than the numerical aperture of the waveguide portion.

Regarding claim 9, the spacing is inherently selected to attain the desired result.

Regarding claims 10-12, 14, 24-26, although not explicitly disclosed as being specific ranges of widths/lengths, a person having ordinary skill in the art at the time the invention was made would have recognized that it was obvious to try certain workable ranges of the widths/lengths, since it has been held that where the general conditions of a claim are disclosed in the prior art, discovering the optimum or workable ranges involves only routine skill in the art. *In re Aller*, 105 U.S.P.Q. 233.

Regarding claims 13, the length *substantially* matches the width in certain embodiments.

Regarding claims 15, the waveguide at least in formed in a channel.

Regarding claims 16 and 29 although not explicitly disclosed as being a strip loaded waveguide, a person having ordinary skill in the art at the time the invention was made would have recognized that using any well-known waveguiding medium in the art was an obvious modification, as no patentable limitation results from using a different (and well-known) coupling waveguide. Strip loaded waveguides are well known for optical coupling performance and ease of manufacture.

Regarding claims 17, 18, 30, 31, 33-35, and 48, although not explicitly disclosed as being silicon or silicon oxide, a person having ordinary skill in the art at the time the invention was made would have recognized that using any well-known semiconductor materials for the grating, such as silicon or silicon oxide or silicon wafers or layered materials, would have been obvious for the purpose of improving optical coupling performance. Official notice has been taken for using silicon or silicon oxide for the semiconductor material.

7. Claims 5, 10-12, 14, 16-18, 22, 24-26, 29-31, 33-35, 46, 48, and 49 are rejected under 35 U.S.C. 103(a) as being unpatentable over O'Brien et al. U.S.P. No. 5,793,521.

O'Brien et al. U.S.P. No. 5,793,521 teaches (Figs. 5, 7, 12a, 30, 31; column 9, lines 19-36; column 11, lines 41-53; column 13, lines 16-36) an integrated optical apparatus comprising: a planar waveguide having an elongate guiding portion 160 and a grating coupler 161, the coupler having at least a flared waveguide portion comprising a narrow end and a wide end, the grating positioned to couple an optical signal between the coupler and an optical element, wherein the grating 161 comprises curved elongate

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scattering elements having curvatures defined by substantially elliptical paths in order to couple waves between the grating coupler and an optical element.

Regarding claims 5, 22, and 49, although not explicitly disclosed as being at least 50% efficient, a person having ordinary skill in the art at the time the invention was made would have recognized that optical efficiency was desired and necessary for the systems (of at least 50%). Official notice has been taken of the efficiency limitation.

Regarding claims 10-12, 14, 24-26, although not explicitly disclosed as being specific ranges of widths/lengths, a person having ordinary skill in the art at the time the invention was made would have recognized that it was obvious to try certain workable ranges of the widths/lengths, since it has been held that where the general conditions of a claim are disclosed in the prior art, discovering the optimum or workable ranges involves only routine skill in the art. *In re Aller*, 105 U.S.P.Q. 233.

Regarding claims 16 and 29 although not explicitly disclosed as being a strip loaded waveguide, a person having ordinary skill in the art at the time the invention was made would have recognized that using any well-known waveguiding medium in the art was an obvious modification, as no patentable limitation results from using a different (and well-known) coupling waveguide. Strip loaded waveguides are well known for optical coupling performance and ease of manufacture.

Regarding claims 17, 18, 30, 31, 33-35, and 48, although not explicitly disclosed as being silicon or silicon oxide, a person having ordinary skill in the art at the time the invention was made would have recognized that using any well-known semiconductor materials for the grating, such as silicon or silicon oxide or silicon wafers or layered materials, would have been obvious for the purpose of improving optical coupling

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performance. Official notice has been taken for using silicon or silicon oxide for the semiconductor material.

Regarding claim 46, it is well-known (at the time the invention was made) to a person having ordinary skill in the art to use optical fibers that have cross-sections being larger than the optical waveguide, for the purpose of having “wobble room” when aligning and coupling optical fibers to optical waveguide media.

#### *Allowable Subject Matter*

8. Claim 50 is objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims. The relevant prior art of record does not teach or reasonably suggest coupling an optical fiber having a transverse dimension that is at *least twenty times* as large as the width of the waveguide and *also twenty times larger* than the length of the grating coupler.

#### *Response to Arguments*

9. Applicant's arguments filed May 22, 2006 in regards to the O'Brien et al. '521 reference have been fully considered but they are not persuasive. First, Applicant asserts that O'Brien does not appear to be related to grating couplers. The Examiner respectfully disagrees. O'Brien '521 has *gratings* 161/162 and *couples* optical signals therethrough. As such, the reference meets the claimed limitations of a “grating coupler”, since it has gratings and couples.

Next, Applicant asserts that O'Brien '521 does not teach that the optical element is located *above* the planar waveguide. The Examiner respectfully disagrees. There are a

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plurality of frames of reference in which the coupled-to optical element of O'Brien '521 could be interpreted as being "above" the grating coupler. For example, if the device of O'Brien '521 were below (with respect to the ground) another optical element in a larger optical system, the optical element would be "above" the grating coupler. Also, the device of O'Brien '521 could be turned on its side to an ordinary observer. Such *frames of reference* do not overcome the teaching of O'Brien '521, at least in the current claimed limitations.

Applicant asserts that O'Brien '521 does not teach a fiber end near the grating coupler (claim 36). The reference of O'Brien '521 (as well as Welch '574, see below) teaches coupling an optical fiber to the end of the grating coupler. The remaining limitations are inherent from the device of O'Brien '521 (as well as Welch '574, see below).

Since Applicant has not asserted any feasible arguments for dependent claims, the rejections to such over O'Brien '521 are maintained. As such, the 35 U.S.C. 102(b) rejections to claims 1-4, 6-9, 13, 15, 19-21, 23, 27, 28, 32, 36-45, 47, 51, and 52; as well as the 35 U.S.C. 103(a) rejections to claims 5, 10-12, 14, 16-18, 22, 24-26, 29-31, 33-35, 46, 48, and 49 are maintained and made final.

10. Applicant traverses the rejections to the Welch et al. '574 reference by making the same argument as O'Brien '521, in which the element is located "above" the grating coupler. The Examiner rebuts with the same "frame of reference" argument as fully addressed above.

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Applicant traverses the rejections to Welch '574 by asserting that there is no teaching of an elliptical curved shape. The Examiner respectfully disagrees, since the Applicant has **claimed** a *substantially* elliptical/hyperbolic shape. The teachings of Welch '574 disclose at least a *substantially* elliptical/hyperbolic shape with at least the curving/transferring portions of the sidewall.

Applicant traverses the combination of the Welch '574 and further in view of O'Brien '521 references in the 35 U.S.C. 103(a) rejections of claims 1-18, 20, 22, 24-26, 29-31, 33-35, 48 and 49. No persuasive arguments are made, and the Examiner has met each requirement of 35 U.S.C. 103(a).

Since Applicant has not asserted any feasible arguments for dependent claims, the rejections to such over Welch '574 are maintained. As such, the 35 U.S.C. 102(b) rejections to claims 19, 21, 23, 27, 28, 32, 36-47, 51, and 52 are maintained and made final; as well as the 35 U.S.C. 103(a) rejections of claims 1-18, 20, 22, 24-26, 29-31, 33-35, 48 and 49.

### ***Conclusion***

11. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure: PTO-892 form reference A.

12. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the

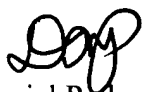
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shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Daniel J. Petkovsek whose telephone number is (571) 272-2355. The examiner can normally be reached on M-F 8:30-5:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Rodney Bovernick can be reached on (571) 272-2344. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.



Daniel Petkovsek  
August 2, 2006



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PRIMARY EXAMINER